Midterm I - Potential Questions

Introduction

1. What do you think Earth System Science is?
2. What was a fundamental conclusion of the most recent Intergovernmental Panel on Climatic Change (IPCC)?
3. What developments in traditional academic disciplines lead to the rise of Earth System Science?
4. What are the 4 basic components of the Earth System?
5. What is the amount (concentration in parts per million by volume) of carbon dioxide in the atmosphere today? What will this value be at $2xCO_2$?
6. What was the concentration of CO_2 in the atmosphere during the Last Glacial Maximum (~20,000 years ago)?
7. How does the Last Glacial Maximum value compare to the amount humans have put into the atmosphere since the industrial revolution? How does the *rate* of change in CO_2 from glacial/interglacial times compare to the modern rate of change in CO_2?

Earth System Science History and Modern Context

1. Who was the first person to postulate the warming effect of carbon dioxide?
2. Who developed the famous modern atmospheric CO_2 curve?
3. Why wasn't the idea that increases in carbon dioxide in the atmosphere could lead to increasing temperatures accepted until well after 1938 when the idea was presented by Guy Steward Calendar?
4. What is the direct radiative effect of increased CO2 today? I think I made a mistake in class and said that this number was the radiative heating effect of doubled CO_2 (which is believed to be about 4 W m^{-2})?
5. Name 3 lines of evidence that suggest temperatures today are warmer than they were at the beginning of the century?
6. What evidence do scientists say supports the idea that humans are having "a discernible" impact on the Earth's climate?
7. List 5 US governmental agencies involved in global change research?
8. What are the 4 funding priorities for US global change research (in other words, what fields should you being going into)?
9. What are the CO2 emissions quotas that were agreed to last year in the Kyoto summit?

10. What is the hottest year in the historical climate record?
11. Approximately how much as the global averaged air temperature increased since the 1880's (make sure you tell me C or F). Have day or night temperatures increased more? Which areas of the world have shown the greatest increases?

Remote Sensing

1. Know the difference between a polar orbiting satellite and a geosynchronous satellite - give an example of each.
2. Be able to distinguish between a SAR and an visible or thermal image
3. Have some idea idea of what physical parameters of interest to global change research can be measured from satellites (hint,hint,nudge,nudge - it may be a good idea to check out NASAs Earth Observing Home page and look at the 24 important parameters we can measure from space). I will probably ask you to list 5 or 6.
4. Be able to explain what wavelengths (micrometers) in which visible and thermal imagery is collected and what sensors are measuring in these wavelenghts. For instance are we measuring surface roughness, temperature, reflectance, the price of tea in China, what?)
5. You may very well get to look at a satellite image or two and tell me a little bit about it (including guessing what area of the world it could be in and why you think that - just to keep you thinking rather than regurgitating).

Models, Models, Models

1. What is a model?
2. What are the three general categories of models? Give an example of each.
3. What are models used for?
4. What does GCM stand for (you had better get this one right there are at least three different meanings)?
5. In what two ways do we attempt to simplify climate models to make them be able to run on a computer?
6. What quantities are important in computer models?
7. Name two types of models used to study climate?
8. What are the typical spatial resolutions of a GCM? A mesoscale model?
9. What is the typical timestep in a GCM?
10. GCM's were organelle designed to study the atmosphere. In what general area or areas are these models being improved? What are some of the impediments to improving GCMs.

11. What is meant by 'parameterization'? Why is it necessary to have good parameterizations?

The Earth's Energy Balance

1. List and describe the three modes of energy transport
2. Understand, Plank's formula or law. What does it mean? Understand Wein's displacement law and how it relates to color temperature. Be able to manipulate these formulas. Don't worry I will provide them so you don't have to remember them, but know how to use them and **BRING A CALCULATOR TO THE TEST. Also know and understand the Stefan-Boltzman equation**. Also know how all these quantities relate at least graphically to the blackbody curve.
3. What is the solar constant (both a definition and numerical value)?
4. How much energy does the earth receive on average over the year at the top of the atmosphere and how does it relate to the solar constant?
5. Understand the net radiation balance equation ($Q^*=K\downarrow+K\uparrow+L\downarrow+L\uparrow$).
6. Define albedo (maybe even using the terms in (5))
7. What are the two types of convective energy transfer?
8. Be able to understand and manipulate our zero-dimensional energy model of the earth
9. YOU CAN BE ASSURED THAT A QUESTION LIKE THIS WILL BE ON THE TEST. Be able to relate the shortwave and the longwave energy balance for a simple planet orbiting the sun at 1 AMU (that is the mean distance from the earth and the sun). This means the planet will have an albedo and an emissivity, but no atmosphere. Think about how this relationship relates to remote sensing… ..

Clouds and Climate

coming soon to a theater near you… ..